New Experimental Data and Analysis of the Ammonia-Water System for Studies of Planetary Atmospheres

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Studies of the atmospheres of the giant planets require an accurate understanding of the vapor-liquid equilibrium for the ammonia-water system. New vapor-liquid equilibrium data for this system have been taken in the Laboratory for Chemical Thermodynamics at Cornell University using a custom-built apparatus. An extensive evaluation of the available literature data has been conducted to assess their quality and thermodynamic consistency.

A refined model for the ammonia-water binary based on the analysis of both the literature data and our own new experimental measurements is presented. This model yields temperature-dependent parameters from which investigators can compute vapor-liquid equilibrium values at any temperature of planetary interest. We have applied our new model to the calculation of ammonia concentration as a function of temperature in condensing ammonia-water clouds for model Jovian atmospheres.

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